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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/588,659

08/07/2006

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EXAMINER

GARRITY, DIANA C

ART UNIT

PAPER NUMBER

2814

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DELIVERY MODE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/588,659	<b>Applicant(s)</b> YANAGITA ET AL.	
	<b>Examiner</b> DIANA C. GARRITY	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 November 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/7/06, 1/9/07</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Information Disclosure Statement***

**1. The information disclosure statement filed January 9, 2007 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed (“Optophysical Property Handbook”); and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.**

### ***Specification***

**2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.**

**3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.**

The following title is suggested: A p-type ZnS based semiconductor material having a low resistance due to its high copper content.

**4. The disclosure is objected to because of the following informalities:**

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- It includes reference to patent 3,078,611 (paragraph 9). Without the appropriate country code, it is read as a US patent. US 3,078,611 is directed toward a fishing bait activator. It should also include a reference to the publication number (i.e. JP 04-234136).
- Paragraph 36: states that the carrier concentration is  $\geq 10^{15} \text{cm}^{-3}$ , although the claims state the carrier concentration is  $\geq 10^{16} \text{cm}^{-3}$ .

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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**5. Claims 1-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dimitrova et al. (V. Dimitrova, J. Tate, Synthesis and characterization of some ZnS-based thin film phosphors for electroluminescent device applications, Thin Solid Films 365 (2000) pages 134-138, hereinafter “Dimitrova”).**

*Regarding claim 1*, Dimitrova teaches a p-type semiconductor material ( $\text{ZnS}:\text{CuCl}_2$ ) material expressed in a composition formula of  $\text{Zn}_{(1-\alpha-\beta-\gamma)}\text{Cu}_\alpha\text{A}_\beta\text{B}_\gamma\text{S}_{(1-x-y)}\text{Se}_x\text{Te}_y$  ( $0.004 \leq \alpha \leq 0.4$ ,  $\beta \leq 0.2$ ,  $\gamma \leq 0.2$ ,  $0 \leq x \leq 1$ ,  $0 \leq y \leq 0.2$ , and  $x + y \leq 1$ , A and B are elements selected from Cd, Hg and alkaline earth metals) (page 136, column 1, ln 3-12; The specification contains no disclosure of either the critical nature of the claimed expression—specifically concerning the amount of zinc—or any unexpected results arising therefrom beyond that as described by Dimitrova. “Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1995). Where patentability is based on a particular range, the Applicant must show that the chosen range is critical *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

*Regarding claim 2*, Dimitrova teaches that  $\beta = 0$ . When  $\beta = 0$ , A is trivial.

*Regarding claims 3 and 4*, Dimitrova teaches that  $\gamma = 0$ . When  $\gamma = 0$ , B is trivial.

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*Regarding claim 5, 11, 12, and 13*, Dimitrova teaches the semiconductor material contains at least one dopant selected from Cl, Br, I, Al, Ga and In as a compensation dopant ( $\text{Cl}_2$ ) and a concentration of the compensation dopant is  $10^{17}$  to  $10^{20} \text{ cm}^{-3}$  (Table 1, Cl (at.%) =  $0.37 \pm 0.01$ , which is equivalent to a concentration of  $7.4 \times 10^{19} \text{ cm}^{-3}$ . For more information, see Application, paragraphs 7 and 10).

*Regarding claims 6, 14, 15, and 16*, Dimitrova teaches the semiconductor material has a light absorption coefficient of  $5 \times 10^5 \text{ cm}^{-1}$  or less at 471 to 750 nm (page 136, ln 41-43). By the equation  $T = 10^{-\alpha l}$ , where  $\alpha$  is the light absorption coefficient,  $l$  is the path length, and T is the transmissivity.

*Regarding claims 7, 17, 18, and 19*, Dimitrova teaches a volume resistivity of the semiconductor material is equal to or higher than  $10^{-4} \Omega \text{ cm}$  and is lower than  $10^3 \Omega \text{ cm}$  (page 136, column 2, ln 20-22).

*Regarding claims 8, 20, 21, and 22*, Dimitrova teaches a carrier concentration (concentration of dopant - in this case, copper) is equal to or higher than  $10^{16} \text{ cm}^{-3}$  and is lower than  $10^{22} \text{ cm}^{-3}$  (Table 1, Cu (at.%) =  $2.38 \pm 0.07$ , which is equivalent to a concentration of  $4.76 \times 10^{20} \text{ cm}^{-3}$ . For more information, see Application, paragraphs 7 and 10).

*Regarding claims 9, 23, 24, and 25*, Dimitrova teaches the p-type semiconductor material of claim 1, constituting a hole injecting (inherent to p-type material) electrode layer (Official

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notice is taken that when ZnS is used in an electroluminescent device – page 134, column 1, ln 1-9 – it is used as an electrode layer) in an amorphous phase or a polycrystalline phase (Abstract).

*Regarding claims 10, 26, 27, and 28, Dimitrova teaches the semiconductor device is a light emitting device (Abstract, and page 134, column 1, ln 1-9).*

### ***Conclusion***

**6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.**

- Kawazoe (US. Pub. No. 2006/0261487): discloses an electrode which utilizes copper doped ZnS.
- Sun et al. (US 6,072,198): discloses a high concentration of copper within ZnS.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA C. GARRITY whose telephone number is (571) 270-5026. The examiner can normally be reached on Monday-Friday 7:00 AM - 3:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anh Mai can be reached on (571) 272-1710. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Diana C Garrity/  
Examiner, Art Unit 2814

/Anh D. Mai/  
Primary Examiner, Art Unit 2814